IMPROVEMENT OF CORN BY SEED SELECTION.

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INTRODUCTION.

Anyone who has made comparative tests of varieties of corn has noticed the great difference both in amount of corn produced and in the forms of the stalks, ears, and kernels of the several varieties. While it is not definitely known from what source corn originated, it is believed that many, and perhaps all, of the existing types have a common origin. These different types have resulted from seed selection or hybridization, which in some cases has been natural, caused by the survival of the fittest or by isolation, and in other cases has been produced by man either intentionally or accidentally. These existing differences among the many varieties of corn, together with their continuous variability, are sufficient proof of the possibility of producing varieties much superior to those now in existence. On every farm changes are taking place in the characters of the corn grown, which may be either beneficial or detrimental. In order that the grower may take advantage of such variations, discarding the detrimental and increasing and rendering more stable the beneficial, it is necessary that the method of growth of the corn plant and the laws of heredity be understood.

If the benefits of careful seed selection should be questioned, it is but necessary to show that the best and most productive varieties of corn now existing are those that have been selected with the most care for a series of years. Whenever corn of this kind is planted in a location to which it is adapted in comparison with varieties of that neighborhood that have had no attention paid to their improvement, the well-selected corn shows its superiority. In many instances the harvest is doubled without extra labor or cost, save the use of good rather than indifferent or poor seed.

POSSIBILITIES OF INCREASE IN YIELD AND IMPROVEMENT IN QUALITY OF CORN.

In some of the great corn-growing sections of the United States little or no attention is paid to the quality of the seed planted. This is largely due to the fact that soil and climatic conditions are so favorable to the growth of corn that what is considered a good crop is obtained notwithstanding the poor quality of the seed planted. In

other sections not so well adapted to corn growing more pains are taken regarding the seed planted and methods of cultivation, and the result is that more corn is harvested per acre than in the sections naturally adapted to corn growing. Thus, for the ten years from 1892 to 1902 the general average yield of corn per acre in the New England States was 36.48 bushels, while in the leading corn-producing States—Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri—the average was but 27.78 bushels, or almost 9 bushels less per acre. For the same ten years the average production of the States of New York, Michigan, Wisconsin, Minnesota, South Dakota, and North Dakota was 27.6 bushels per acre, and of New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, and Virginia 26.97 bushels per acre, while the States of South Carolina, Georgia, Alabama, Mississippi, Louisiana, and Texas averaged but 13.59 bushels per acre.

The average production of corn in the United States from 1892 to 1902 was 23.51 bushels per acre, which is less than one-third of what it might and should be if proper methods of seed selection and cultivation were practiced. Good farmers frequently raise from 75 to 100 bushels of corn per acre. The secret of a good yield consists in causing each stalk in the field to produce a good ear. This should be the case if every stalk grew from a well-developed kernel from a good seed ear and had its requisite amount of space in the row. Good-sized ears of the commonly cultivated varieties of corn will weigh about a pound a piece. When the stalks stand 18 inches apart in rows 3½ feet wide, there are 8,297 stalks to the acre, and if each of these stalks produces an ear weighing 1 pound, the yield will be 122 bushels of ear corn per acre, estimating 68 pounds per bushel.

Just as there is the possibility of a very great increase in the quantity of corn produced per acre, so there is the possibility of a very great improvement in the quality. It is hoped that in the near future the quality of the corn will govern its price more than is the case at present. It is as unfair to have one price for all grades of corn as it would be for a creamery to pay one price for milk without regard to its quality. Grain buyers realize that one lot of ear corn is sometimes worth much more than another, because it gives more shelled corn per bushel, but as yet they seldom pay any more for the better corn. The same price is paid to all, on the theory that where one man's corn falls short in shelling, that of another will overrun sufficiently to bring up the average. A carload of 800 bushels of ear corn like the ear shown in Pl. LXXI, fig. 1, would yield but 728 bushels of shelled corn, while a similar carload like the ear shown in Pl. LXXI, fig. 2, would yield 893 bushels.

The nutritive value of corn is also a line along which there is much room for improvement. The same is true of the flavor, sweetness, and richness of table corn. A hardy and productive corn having

the good table qualities of some that are deficient in hardiness or productiveness would be heartily welcomed by canners, as well as by consumers in general.

CORN A WIND-POLLINATED PLANT.

The two important facts that must be kept in mind by one striving to produce a valuable variety of corn are, first, that selecting and continued planting of corn having certain desirable characters will gradually increase the characters and render them more stable; and, second, that every seed kernel has within it the latent characters of two parent plants, the mother plant, upon which the kernel grew, and the father plant, from which the pollen came that fertilized the kernel. Some give attention only to the plant upon which a seed ear grows and lose sight of the fact that the characters of the plant from which the wind brought the yellow dust-like pollen exert as great an influence in determining the characters of the corn that will grow from the seed as do the characters of the plant upon which the ear grew. One can make some progress toward the improvement of a corn by giving attention only to the seed ears and the plants upon which they grow, but the progress will not be as rapid as it may be made by also giving attention to the pollen parent. Furthermore, a corn can never be made to attain any satisfactory degree of fixedness or uniformity if planted within wind-pollinating distance of other types of corn. Studies of xenia[a] and the planting of corns of different colors in adjacent fields have shown that wind readily carries corn pollen several hundred feet, and that a quarter of a mile is a safe distance to separate varieties to prevent a troublesome cross pollination. Many growers express surprise that ears of so many forms and colors are found in their corn, although they always select for seed, ears of their favorite type. The explanation is that cross pollination with other types of corn has taken place. Perhaps a neighbor grows another kind of corn in an adjacent field, or the grower's own truck patch of sweet corn and popcorn may be at the end of the cornfield, and the wind carries the pollen of these various corns to the silks of the field corn from which he selects seed. As surely as the pollen from the popcorn or sweet corn has fertilized the silks of any of the ears afterwards selected as seed ears, so surely will some of their characters appear in the next crop, and the grower wonders whence come ears of so many types when he knows he planted seed from ears of no such types. A few simple experiments, which can be performed in a short time by any corn grower, would produce results that would vividly impress upon his mind the indispensable value of the pollen the wind shakes from the corn tassels and the various effects produced by cross pollination. If a shoot of sweet corn be covered with paper

[a] Bulletin No. 22, Vegetable Physiological and Pathological Investigations, U. S. Dept. Agr., 1900.

or muslin before any silks appear, so that the silks are never allowed to become exposed to pollination, no kernels whatever will be formed. If, however, some pollen from the tassels of a field corn be placed upon the silks of a similarly inclosed shoot of sweet corn it will be found when the ear ripens that the kernels produced much resemble the field corn, being quite different from kernels of other ears on the same stalk.

IMPORTANCE OF STALK, EAR, AND KERNEL IN SELECTING SEED.

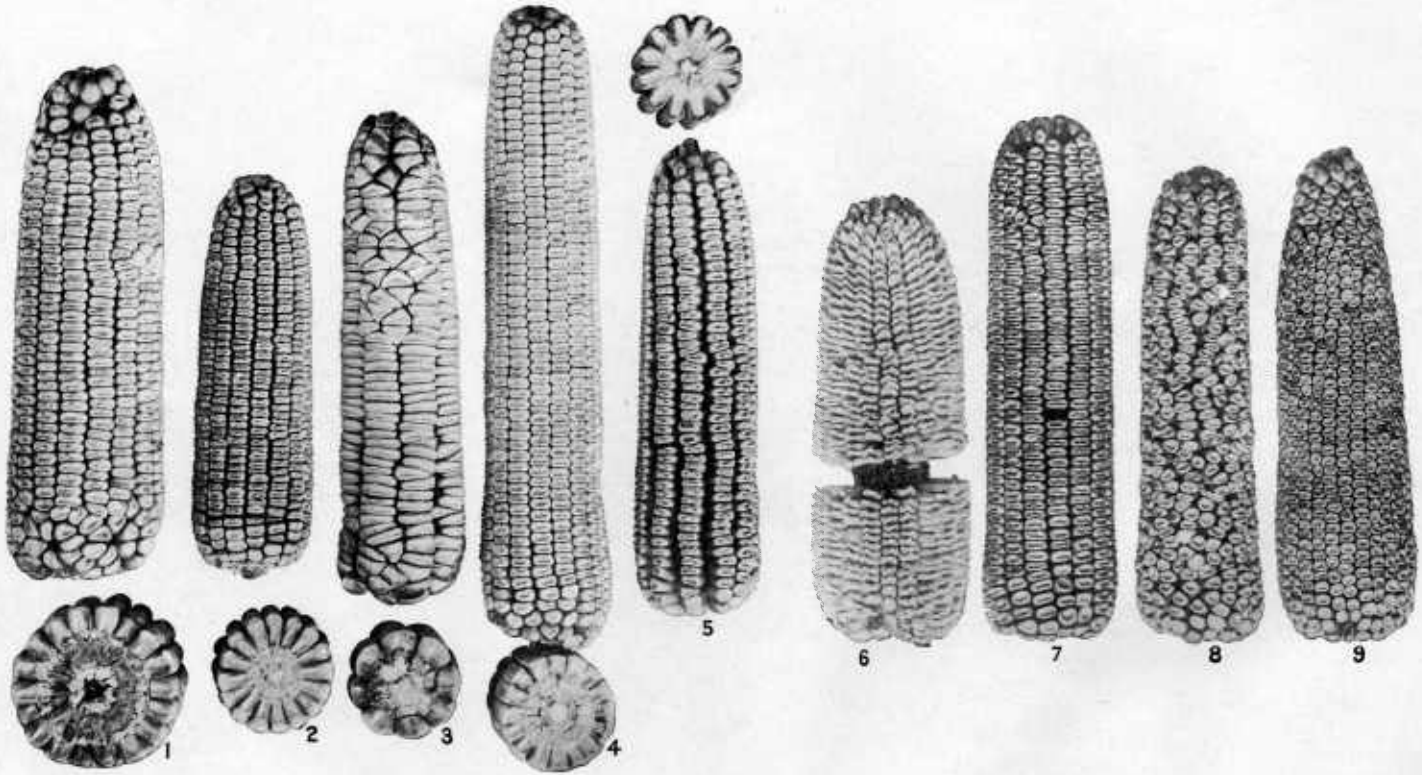
In order to show the necessity of giving attention to the characters of stalk, ear, and kernel in selecting seed, six experiments will be briefly described. The first two experiments show that seed ears transmit the characters of the parent stalks.

In the summer of 1900 a stalk of the variety known as Pedrick's Perfected Golden Beauty was noticed to have exceptionally broad leaves. A shoot on the stalk was inclosed in a paper bag, and when the shoot grew into full silk the silks were pollinated with pollen from the same stalk. Seed from the resulting ear was planted in 1901 and the plants produced were very noticeable during the summer because of their very broad leaves. Many of the leaves were 6 inches broad and sufficiently extraordinary to attract the attention of all who passed by the row. Pl. LXXII, fig. 2, shows the first stalk in the row and the broad blades can be compared with the blades of an ordinary stalk like that shown in fig. 1 of Pl. LXXII. Seed from this row planted in 1902 produced plants which exhibited the same character.

In 1901 in a field of tall-growing white dent corn a few short and very leafy stalks were noticed. Three of these stalks are shown in Pl. LXXIII, fig. 1. These stalks were but from 4 to 5 feet tall and bore from 18 to 20 broad blades, while the normal stalks of the same corn were 10 feet tall but bore fewer blades. The tassels and shoots of these leafy plants were bagged, as shown in the illustration, and at the proper time were cross pollinated by hand one with another. The resulting seed was planted in 1902 in one row of a field planted with seed from the normal tall stalks of the same corn. How very much this row resembles the parent stalks is shown in Pl. LXXIII, fig. 2. The difference in the appearance of the stalks in this row from those seen in the rows on either side is the result of one year's seed selection with reference to the characters of the parent stalks.

The following experiment illustrates the power of seed ears to transmit their own characters even when the characters of the pollen plant are left out of consideration. The object of the experiment was to verify the usually accepted truth that "like begets like" by showing that ears possessing a low percentage of shelled corn, that is, having a small amount of corn in proportion to the weight of cob, would produce a crop low in percentage of shelled corn, while seed ears high in percentage of shelled corn would produce a crop correspondingly high

PLATE LXXI.



EARS OF CORN OF DIFFERENT TYPES.

Yearbook U. S. Dept. of Agriculture, 1902.

FIG. 1.—BARREN AND PRODUCTIVE STALKS OF CORN.

FIG. 2.—PROGENY STALK, SHOWING TRANSMISSION OF BROAD-LEAFED CHARACTER.

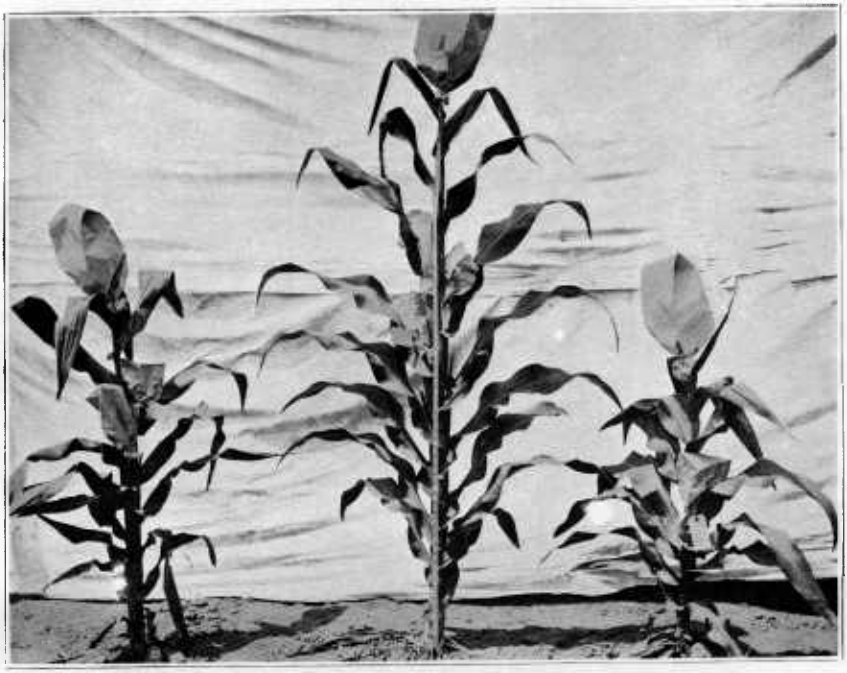


FIG. 1.—PARENT STALKS OF CORN.

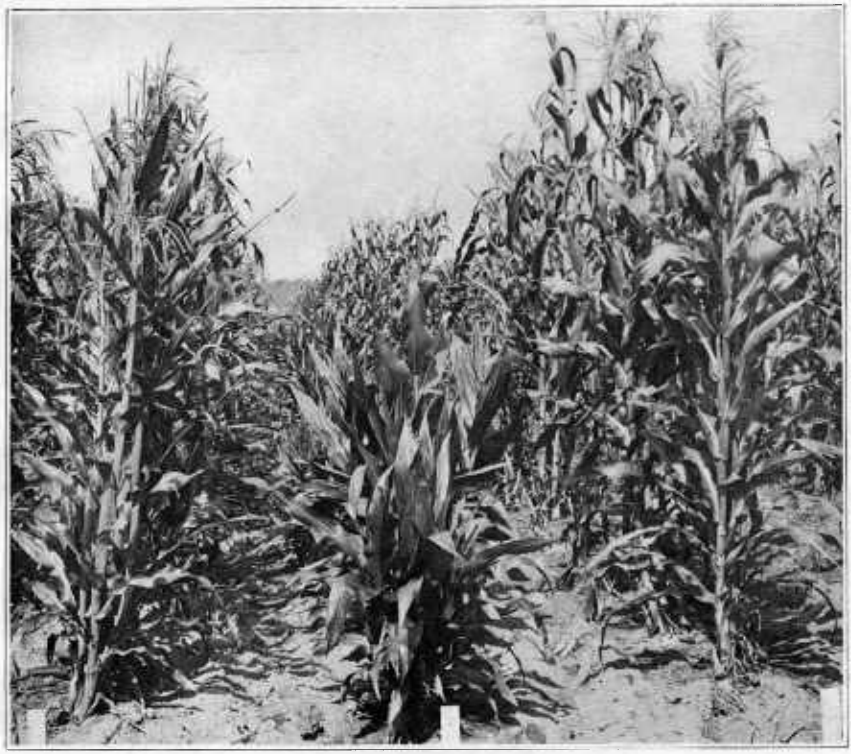
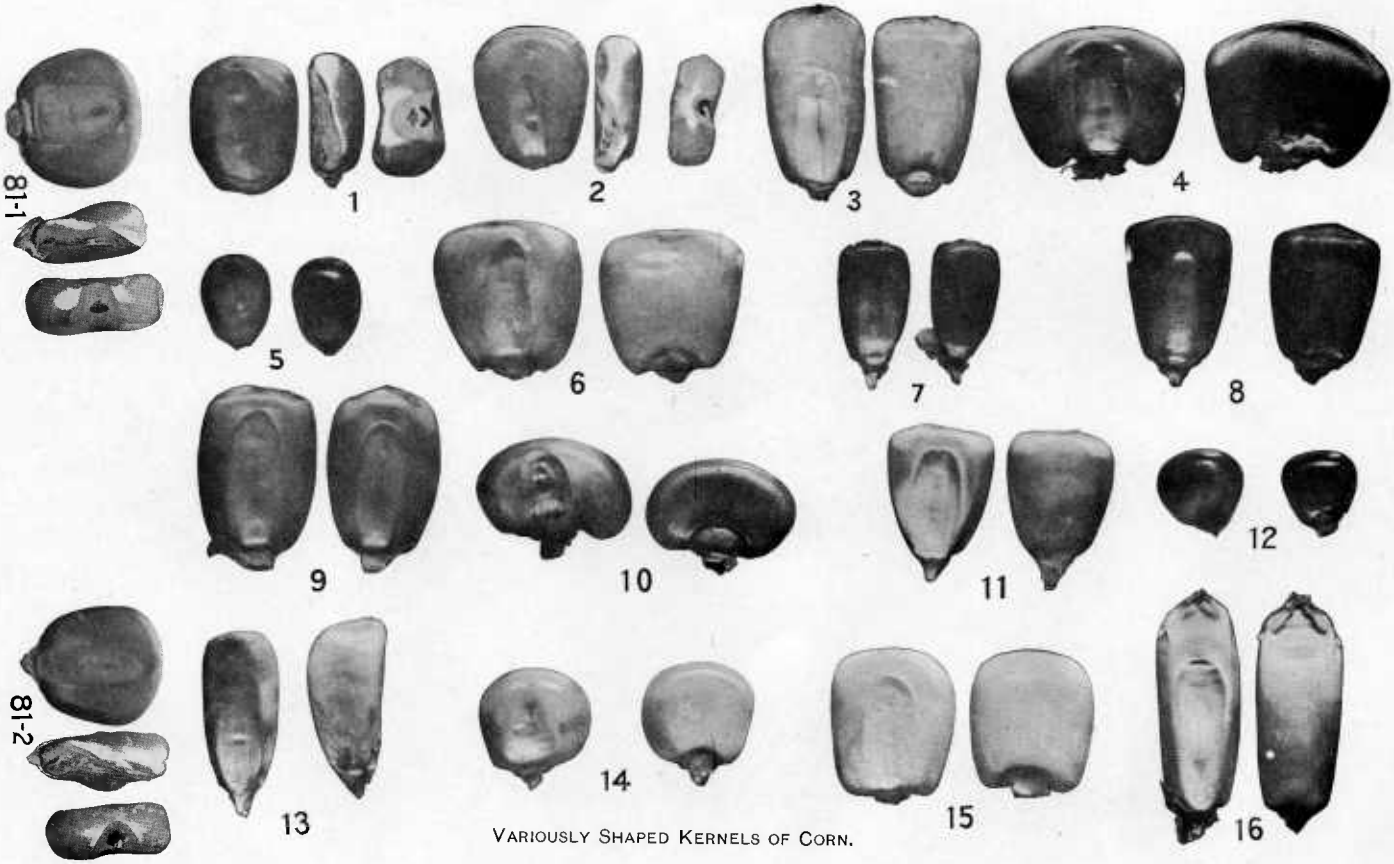


FIG. 2.—PROGENY IN CENTRAL ROW FROM STALKS SHOWN IN FIG. 1.



VARIOUSLY SHAPED KERNELS OF CORN.

Yearbook U. S. Dept. of Agriculture, 1902.

in its percentage of shelled corn. For this experiment four flint and two dent ears were selected, two of the flint ears being low and two high in percentage of shelled corn for that variety. The two ears of the dent variety did not differ very greatly. The following table gives the percentage of shelled corn of each of the seed ears and the percentage of shelled corn of the entire progeny of each seed ear, the diameter of the cobs of the seed ears, and the average diameter of cobs of the progeny:

Transmitting qualities of individual ears of corn.

Type.	Selection number of seed ears.	Percentage of shelled corn of seed ears.	Percentage of shelled corn of all progeny ears.	Diameter of cob of seed ears.	Average diameter of cob of progeny ears.
				Inches.	*Inches.*
Flint	85–2	73.1	73.8	1.37	1.27
	85–1	73.2	74.6	1.37	1.24
	85–3	81.1	77.1	1.00	1.10
	85–4	84.6	78.5	1.12	1.11
Dent	86–1	83.4	82.4	1.12	1.15
	86–2	85.1	84.7	1.12	1.16

A study of the above table shows that each seed ear transmitted its characters to its offspring. Another test of seed ears with reference to their length has shown that the longer the seed ear the greater was the average length of ear of the progeny.

While it is true that the kernels of an ear vary somewhat in regard to the size of germ, there is nevertheless considerable uniformity, so that ears can be selected having kernels with large germs, and consequently rich in oil and proteids, other ears of the same corn having kernels with small germs. Last spring large-germed and small-germed ears were selected from several varieties of corn and planted to test the degree to which the germs of large and small sizes would be transmitted. The harvest has shown that, almost without exception, the germs of the progeny of the large-germed ears are plainly larger than those of the progeny from the small-germed ears. Pl. LXXIV, fig. 81–1, shows longitudinal and cross sections of grains from a large-germed seed ear, and Pl. LXXIV, fig. 1, shows similar sections from an ear produced by this seed ear. Pl. LXXIV, fig. 81–2, shows sections of a small-germed seed ear, and also (fig. 2) sections from an ear produced from it.

It has just been shown that seed corn transmits the characters of the stalks from which it is gathered, and also that the characters of the seed ears themselves reappear in the ears harvested. It will now be shown that the various kernels of an ear possess an individuality that is transmitted to their progeny.

Pl. LXXV, fig. 1, shows a remarkable ear occurring in a field of white

dent corn which had for many years been grown as a reasonably pure corn, but which occasionally, as many white corns do, produced a red ear. This particular ear was red, but bore a white spot which covered about one-fifth of its surface. The kernels composing the white spot, although appearing very white in contrast with the red ones, revealed on closer examination fine red lines, or streaks, radiating from the caps down the sides of the kernels. These two types of kernels from this spotted ear were planted in separate rows. The red kernels produced a crop of 84 red ears, one of which is shown in Pl. LXXV, fig 4, and 86 pure white ears, like that shown in Pl. LXXV, fig. 3. The white kernels with fine red stripes produced 36 pure white ears and 39 ears having kernels like those planted, one of the 39 being shown in Pl. LXXV, fig. 2. In other words, each of the two types of kernels produced a crop of ears about 50 per cent of which had kernels like those planted, the remaining ears in each case being white.

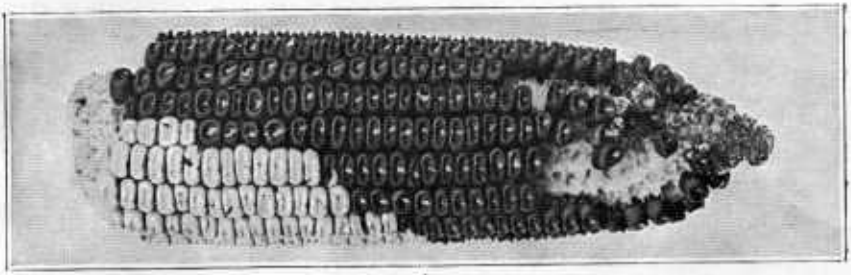
The above experiment illustrates the behavior of kernels on an ear that can properly be called a "sport" or sudden variation from the type. From the following it will be noticed that the various kernels of a hybrid ear follow the same rule of transmitting their individual characters. In 1900 a shoot on a stalk of Pedrick's Perfected Golden Beauty corn was pollinated with pollen from a hybrid of Pedrick's Perfected Golden Beauty and Cuzco. The immediate effect of this pollen was the production of an ear with three-fifths of its kernels of the normal yellow color, the remaining two-fifths having been changed by xenia, or the immediate effect of pollen, to various shades of plumbeous and purple. These two types of kernels were planted separately in 1901. Those of various shades of plumbeous and purple produced ears with about equal numbers of yellow, yellowish, and plumbeous kernels, as is shown by the three ears on the left in Pl. LXXVII. Of the ears produced by the yellow kernels more than half had only yellow or yellowish kernels, as is shown by the two ears in Pl. LXXVII, *E* and *F*, while the remaining ears had some plumbeous kernels. In 1902 kernels from the hand-pollinated ear shown by *F* produced a crop having no dark kernels whatever, and the plumbeous kernels from the hand-pollinated ear shown by *B* produced ears, all of which were much like the one shown by the same figure. It is thus seen that the color of corn kernels is fully under the control of the person selecting seed, and that ears of the desired color can be obtained in a very few years.

POINTS TO BE CONSIDERED IN MAKING SELECTIONS.

Since the kind of crop harvested depends so much upon the kind of plants from which the seed is selected, it is of vital importance to give great attention to the process of seed selection.

STALKS.

No accurate description can be given in a general paper of this kind of the type of stalk from which to select, for the corn must suit



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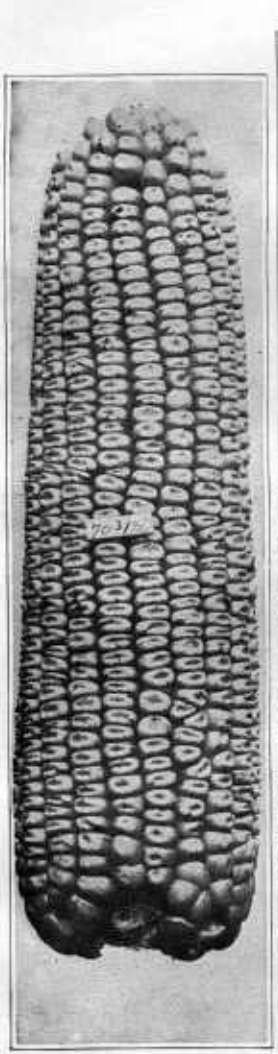

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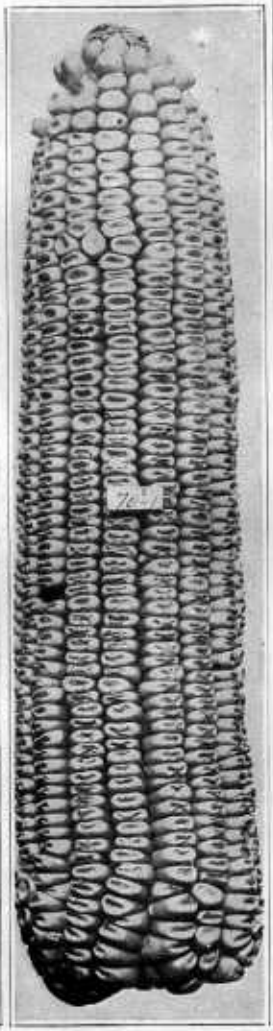
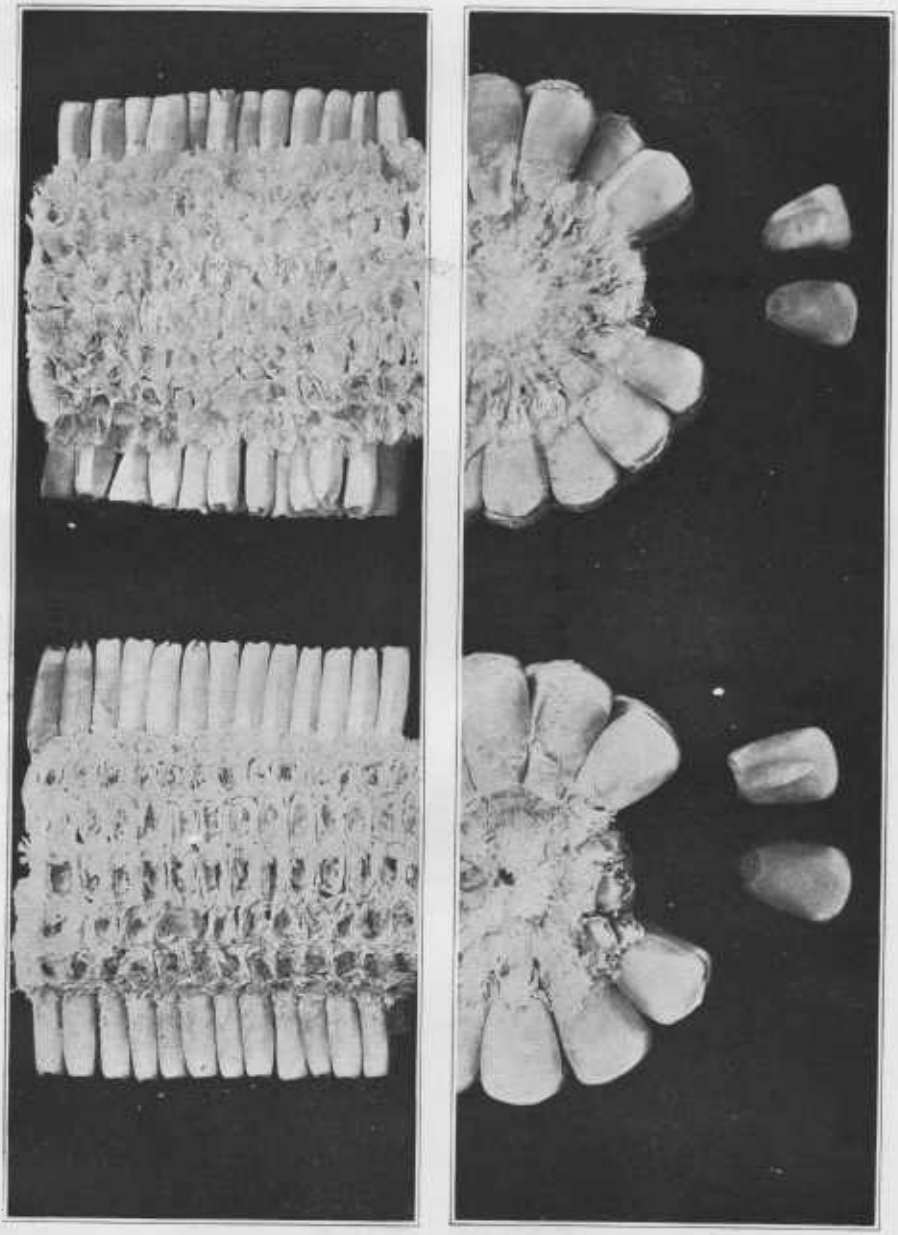


3.

4.

PARENT EAR OF CORN AND SPECIMENS OF PROGENY.

[1, Seed ear planted; 2, 3, 4, types of ears harvested.]



VARIATION IN SIZE OF COB AND LENGTH OF KERNELS OF TWO EARS OF THE SAME VARIETY OF CORN.

the purpose for which it is grown. For ensilage purposes the stalk should be rich, succulent, leafy, and remain green and tender until the ear has reached considerable development; but if ear corn is the only product desired, the qualities of the stalk should be such as will best lead to the proper development and support of one or more good ears. The productiveness of a stalk is, of course, the point of most importance. A stalk great in circumference near the ground and tapering gradually to the tassel, with sufficient foliage of vigorous appearance, free from diseases and bearing a good ear or ears at a convenient height, is a desirable stalk from which to select seed. A thick, stout stalk can withstand extremes of weather for a longer period and with less injury than a slender stalk, and is less apt to blow down and cause the ear to decay on the ground. The height at which the ear is borne is a point of considerable importance, and seed selection with reference to this point is governed by the locality. In Missouri, Tennessee, Mississippi, and fertile districts in the South, ears are produced so high with some varieties as to make the work of shucking very laborious, while in Minnesota and North Dakota, where the ears are borne but 1 or 2 feet from the ground, the desire of growers is to obtain a corn that will ear high enough so that corn harvesters can be used to cut the corn below the ears. Besides the difficulty of gathering ears that are high up on the stalk, when in such position they exert an increased strain on the stalk and render it more liable to be broken by windstorms. At one locality in Ohio where the Department of Agriculture is carrying on selection work with one variety, measurements of many stalks showed that large, well-developed ears varied from a height of 3 feet to 8 feet from the bottom of the stalk.

If the corn is to be shucked by hand and shelled or sold for milling purposes a variety that produces one large ear to the stalk can be most economically grown, but if shredders are to be used and the ears are to be fed to cattle, a variety that produces a greater number though smaller ears per stalk will give better satisfaction.

EARS.

While in the field selecting seed ears one must always have in mind the type of ear toward which he is striving. It is a good plan to reserve for comparison an ear that comes nearest the ideal ear, but it must be remembered that the ideal ear will not be found, because no ear is in all respects perfect. Success depends on a strict adherence from year to year to the type it is desired to attain and fix. The leading qualities that will recommend the ears of a variety suited to most general purposes are: High percentage of shelled corn to cob; soundness of ears and kernels; high nutritive value of the kernels; uniformity in size and shape of ears; purity in color of grain and cobs.

The percentage of shelled corn of good quality is the most important character the ears can possess, because next after the productiveness

of the stalk it most influences the feeding value of a crop. Well-filled ears of different varieties vary from 75 to 92 per cent. Different ears of the same variety will vary 10 per cent in this respect because of the relation of the length of kernels to the size of the cob. Pl. LXXVI shows such a variation in a white dent variety. The proportion of grain to cob is influenced by the following: Length and solidity of kernels in proportion to size and composition of cob; filling out at butts and tips; space between the rows of kernels; uniformity in shape and arrangement of kernels.

While great weight of grain in proportion to weight of cob is highly desirable, it is not to be understood that it is advisable to have as small a cob as possible. The small-eared corn represented in Pl. LXXI, fig. 2, has rather too small a cob. The pressure of the kernels causes many of the cobs to break, allowing the tip portion of the ears to drop out of the husks before the harvest. A larger cob with proportionately longer kernels and less space between the rows of kernels would be a great improvement to this corn, and would not reduce its high percentage of grain. Many varieties have the failing of not filling out at the butts and tips, thus leaving one or more inches of cob destitute of kernels. Spells of dry weather may increase this fault, but under equal conditions varieties highly selected with reference to this point fill out better than do those not so selected. Pl. LXXVII, *A*, *B*, and *C*, although reproduced for another purpose, illustrate ears poorly filled at the extremities, while Pl. LXXI, fig. 7, shows a well-filled ear.

Other things being equal, ears with wide sulci, a name given to the space between the rows of kernels, and as illustrated in Pl. LXXI, fig. 5, will not yield as high a percentage of grain as ears with narrow sulci (Pl. LXXI, fig. 4). Neither can ears with crooked or irregular rows, which produce ill-shaped kernels (Pl. LXXI, fig. 8), have as high a percentage of grain as straight-rowed ears having kernels uniform in size, shape, and arrangement.

The necessity of having well-matured ears with dry, sound kernels and cobs is so great that it is not apt to be overlooked by even the most careless grower; but if it should be, it is brought to his attention when the crop is offered for sale. A variety that matures properly and is sound in one locality is frequently found to be unsuited to a more humid climate, the ears becoming soggy or moldy.

There are not a great number of varieties that have been selected sufficiently long and rigidly to fix them to distinct types that will enable them to be unmistakably identified; but that there are some such varieties proves the possibility of fixing a type. While it is desirable that a variety should have some distinctive characters of ear or kernel, it is not advisable for a breeder to select for a character that is subject to some objection. It is not necessary that all varieties should have cylindrical ears (Pl. LXXI, fig. 7), but this is the shape that best permits of a high percentage of grain and uniform size and

PLATE LXXVII.

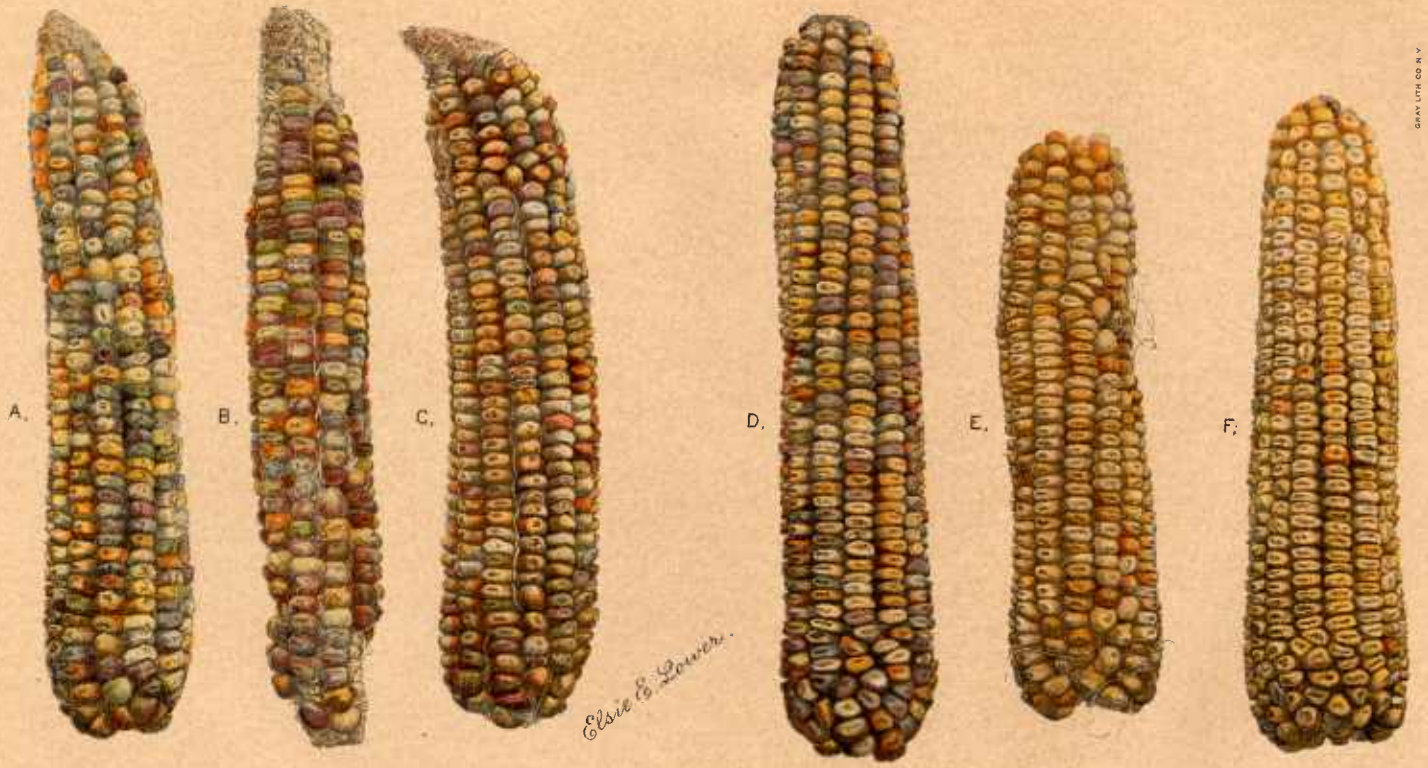


FIG. 1.—PROGENY EARS RESULTING FROM PLUMBEOUS KERNELS SELECTED FROM AN EAR LIKE D.

FIG. 2.—TWO EARS ON RIGHT SHOW CHARACTER OF EARS PRODUCED FROM YELLOW KERNELS TAKEN FROM EAR LIKE D.

VARIATION IN CORN HYBRID.

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shape of kernels. If the ears are conical (Pl. LXXI, fig. 9), it is necessary that the grains near the tip be smaller or that some of the rows do not extend to the end, thus causing some kernels to be irregular in shape. Grains of irregular sizes and shapes can not be planted evenly with corn planters.

Manufacturers of white-corn goods prefer that the cobs be white, for in manufacturing white grits, meal, or flakes it is difficult to prevent some particles of cob from adhering to the kernels, and if the cob be red such particles show conspicuously and detract from the appearance of the finished product. For yellow corns, red cobs are not objectionable.

KERNELS.

The selection of seed ears having very long kernels is the best means of producing a corn with a high percentage of grain, but in selecting for long kernels quality must not be overlooked. Frequently the quality of kernel is very poor on ears having the longest kernels. Pl. LXXI, fig. 6, shows such an ear, and Pl. LXXIV, fig. 16, shows two kernels from this ear where the soft, chaffy nature of the apical portion can be noticed. The best shaped kernels are those of good length, which gradually broaden from the base or point of attachment on the cob to the cap, thus leaving the least space unoccupied. Pl. LXXIV, figs. 3 and 8, show well-shaped kernels for general-purpose corns. For the manufacture of hominy, hard kernels from which the germs separate readily, leaving the rest of the kernel in one large, flinty piece, are desirable. The flint ears, with their broad, round-capped, kidney-shaped kernels (Pl. LXXIV, fig. 10), yield a low percentage of grain, and are in many localities being discarded for longer-kerneled types.

Purity of color is one of the easiest results for the corn breeder to accomplish and is very desirable for milling corns. Some markets desire a golden-yellow meal and others a pure white, but there is no special demand for meal from a mixed corn.

As has already been shown, there is an individuality attached to each kernel on an ear, but it will seldom be practical for growers to make any distinction when shelling seed ears except to discard the small kernels at the butts and tips of the ears. It has been demonstrated by the Department of Agriculture that such kernels produce a greater percentage of feeble and nonproductive stalks than do the full-sized kernels from the same ears, and growers are recommended to "nubb" their seed ears. A good plan to follow when shelling seed corn is to remove the small kernels from butts and tips and shell each ear separately into a pan, so that the kernels can be examined before placing them with the seed from other ears. Where a large supply of seed is needed the ears can be nubbed by hand and shelled with a sheller.

IMPORTANCE OF A SEED PATCH.

Every grower who raises his own seed corn should plant his very choicest seed ears in an isolated patch from which to select his seed for the following year. If his farm does not admit of such an isolated seed patch, it can constitute a number of rows in a field of the same kind of corn, which, of course, should also be planted with choice seed. The seed patch should be located on the same kind of soil as that in which the seed selected from it is to be planted. If the corn is to be grown on upland clay soil, the seed should be selected from year to year from corn grown on similar soil.

The choicest ears should be planted separately in the seed patch. If the rows are long a row can be planted with seed from each ear. This separate planting is highly desirable, because some ears produce better than others and are those from whose progeny it is advisable to select seed for the next year. Not many, except those who have tried the plan, will believe that when a patch is so planted with individual ears of the same variety some rows will be so unlike as to be easily distinguishable. The seed patch should have uniform conditions of soil and drainage, so that the difference in production of the various rows will indicate the comparative productiveness of the seed ears. One of the many objections to selecting seed from a crib is that a large ear found there does not necessarily indicate the tendency of the parent plant to produce a large ear. It is not unlikely that the ear is large because it grew in a particularly fertile portion of the field, and may therefore be a much less desirable seed ear than a smaller one that grew under less favorable circumstances.

Some rows will be so feeble that it will be desirable to remove the tassels from all the stalks in them before the pollen is discharged. In the seed patch, the size of which will depend upon the amount of seed needed, all feeble, diseased, and nonproductive stalks should have their tassels removed before they shed their pollen; otherwise these undesirable stalks will furnish pollen that will fertilize some of the ears that may afterwards be selected for seed.

At the time the corn is tasseling it is not always easy to tell the stalks that will not produce ears, but if a stalk is in tassel and almost sufficiently advanced to discharge its pollen, and shows no shoot or indication of the formation of an ear, it is well to remove its tassel. An abundance of pollen is produced, so that the detasseling of all the poorer stalks to the extent of half the stalks in the seed patch will not interfere with good pollination. A short time after the pollen is shed it is easy to distinguish between barren and productive stalks. (Pl. LXXII, fig. 1.)

The work of the Department of Agriculture is yearly giving evidence that the removal of barren stalks from the seed patch reduces the percentage of barren stalks in the next year's crop. No field of well-selected corn, under average conditions of weather and cultivation,

should contain more than 4 to 5 per cent of barren stalks. In the fall of 1902 a count of 25,507 stalks showed that a field planted with seed gathered from a seed patch from which most of the barren stalks were removed in 1901 contained 3.43 per cent of barren stalks, while two other fields of the same corn, under the same conditions of soil and cultivation, but planted with seed from the crib, contained 8.11 per cent of barren stalks.

TIME AND MANNER OF SELECTING SEED.

If it is desirable to have the variety mature earlier, it is necessary to perform seed selection just as soon as the corn begins to ripen, and to select ears only from the early maturing stalks. On the other hand, if a later maturing corn is wanted, the selection should be performed after the corn is quite ripe, seed being taken only from stalks still remaining green. If the variety is thoroughly acclimated, so that it occupies all the good growing season and ripens at the proper time, the selection can be made at any time after the corn is ripe and before freezing weather. There seems to be quite a general demand throughout the country for earlier maturing varieties, but it should be remembered that the shorter the season of growth the less chance the corn has of growing a heavy crop. In general, the early varieties are less productive than varieties requiring longer growing seasons.

Some farmers have adopted the plan of selecting their seed while gathering their corn from the standing stalks, having a box in the wagon into which are thrown the good ears as they are found. While this is much better than no selection, it is only doing in an easy manner what might be better done. One can do work better by giving his whole attention to one thing at a time, and no one can do a good day's work husking corn and at the same time find the best seed ears in the field.

The seed patch having been planted as above described, the rows that have not produced well can be entirely ignored and seed taken only from those rows whose general appearance shows that they were planted with seed from desirable ears. By passing along these productive rows, the attention will be attracted by good stalks bearing good-sized ears at the proper height, and if, after stripping back the husk of such an ear, it proves desirable, it can be gathered, placing all ears from each seed row in a separate sack, on which is placed the number of the seed row. After this each seed row can be shucked separately, throwing the corn into a wagon and weighing it. By this means the most productive rows in the entire patch will be determined, and the seed already selected from them and sacked can be used in planting a similar seed patch next spring, while the other sacks of seed selected can be used for the general planting. This process of seed selection may impress some as being too tedious, but if properly performed it will be found highly profitable. When it is remembered that an acre

planted with seed from a dozen good ears will produce 10 or perhaps 20 bushels more than if planted with poorer seed, it is readily seen that it is worth considerable effort to obtain good seed ears.

KEEPING SEED CORN THROUGH THE WINTER.

After having been properly grown and selected, seed corn may be greatly reduced in vitality by injudicious care during the winter. It is the vitality of the seed and the nutriment stored in the seed that sustains the young plants during their first week of growth, and the success of a crop depends much upon the vigor with which the young plants begin growth. By those who take pains to select seed in the fall, not many serious mistakes are made regarding its preservation, although some do not give the seed as good treatment as they might easily do. Any means that secures a thorough drying of the seed ears soon after they ripen, before freezing weather, and keeps them dry until the seed is planted will be a success. It must be remembered that although seed corn is thoroughly dried, it will not remain so if exposed to a saturated atmosphere. The kernels absorb moisture, and if exposed to changes in temperature while moist, their vitality will be injured. A thorough drying of seed ears, by artificial heat if necessary, and their preservation in a dry atmosphere and at a steady temperature, is strongly recommended. During the past year seed dried by fire and kept dry and at a steady temperature during the winter was planted, in comparison with seed from the same fields which was suspended in barns at husking time and left exposed to atmospheric conditions of temperature and moisture. The tests were made on different soils and in different States by planting 10-acre patches, so that the well-preserved or fire-dried seed was planted in alternating rows with the air-dried seed, that is, a row was planted with fire-dried seed and then one with air-dried seed, and so on throughout the 10-acre fields. There was no perceptible difference in the rapidity of germination; 70.9 per cent of the air-dried and 73.8 per cent of the fire-dried seed grew and survived. These percentages were obtained by counts made after the plants had reached a height of about 8 inches. A count made at harvest time proved that the stalks had increased by growth of suckers 19.7 per cent in the "air-dried" rows and 29.4 per cent in the "fire-dried" rows. The crop from each row was weighed separately, and in all cases each "fire-dried" row produced more and better corn than the "air-dried" rows on either side of it. The greatest difference was on good soil on the Potomac River bottoms, where the fire-dried seed produced 18¼ bushels more corn per acre, the average yield from the "fire-dried" rows being 85.59 bushels of ear corn per acre, in comparison with 67.34 bushels from the "air-dried" rows.

Although all the rows were planted by hand, with 3 kernels in every hill, and germinated almost equally well, as above shown, at harvest

time the "fire-dried" rows contained 12.5 per cent more stalks than the "air-dried" rows. This, however, was not the leading cause for the increased production, for the total average production per stalk in the "fire-dried" rows was 0.672 pound, as compared with 0.618 pound per stalk from "air-dried" seed.

On upland clay soil "fire-dried" seed produced 63.92 bushels per acre, while "air-dried" seed produced 56.88, a difference of 7 bushels in favor of the seed that had special care taken of it during the winter.

While it may not be practicable for all growers to keep their seed corn dry throughout the winter by means of fire, it is possible for all to dry the seed ears thoroughly in the fall and then place them where they will remain dry and not be subjected to extreme weather conditions.

ADVISABILITY OF BUYING SEED CORN.

Many growers entertain the idea that the growing of the same corn for years on one farm will cause it to "run out." Such is not the case. It is the lack of attention to seed selection that causes the deterioration and not the continued growing of the same corn on one farm. It is true that the corn on many farms does become poorer from year to year. Such is likely to be the case where any farmer who gives no attention to seed selection or the detrimental effects that may follow cross pollination, or mixing, starts with highly bred seed and expects the corn to retain indefinitely its good features without yearly attention to the principles of proper seed selection. It is the inherent tendency of plants to vary that makes improvement possible, and whether the strain of corn grown on any particular farm shall become poorer or shall become better year by year depends on whether seed below or above the average of the strain is yearly selected. Carefully conducted experiments prove that it is possible to make corn poorer in quality and productiveness by the selection of seed from poor individuals; and those who use their best corn during the winter and plant such as is left in the spring, and those who eat as roasting ears the earliest and best ears in the patch and take their seed from such as remain, are constantly repeating these experiments. It is no wonder their corn becomes poorer, or, as it is commonly expressed, "runs out."

It is deemed highly advisable to improve a corn in the district and on the kind of soil where it is to be afterwards grown. It is true that a well-bred variety may sometimes be sent hundreds of miles from the place where it was improved and there be found superior to the native varieties with which it comes in comparison, while, on the other hand, a change in the conditions of soil and climate may cause a change in the corn or its habits of growth, so that a valuable variety for one State may be worthless for another State. For this reason extensive importation of seed corn from another locality where the

soil and climatic conditions may be different should not be made without first testing the variety on a small scale.

To produce a desirable grade of seed corn requires considerable attention and work, but the better quality and larger quantity of corn that will grow from it will more than pay for the labor. Any corn grower who has not the time, ability, or a suitable location to grow and select seed corn of a high grade should each year buy his seed and willingly pay several dollars a bushel for it, but he should be sure that the seed he buys has been properly bred and selected. One safeguard in buying is to insist that the seed be delivered as ear corn. Sellers of seed corn offer several reasons for their unwillingness to ship seed corn on the ear, but if honestly expressed the chief reason would be that by so doing they are unable to dispose of poor and small ears. When viewed in the proper light there are no good reasons that will prevent the selling and shipping of seed corn on the ear, and certainly as much profit can be made by selling good seed corn at an advanced price as by selling for seed purposes and at low prices corn which it is unwise for anyone to plant. The reform can best be accomplished by all who buy seed corn insisting that it be delivered on the ear. Growers can then at least know from what kind of ears their seed was shelled. Seedsmen find it to their profit to meet the demands of their patrons, and if the demand for unshelled seed corn becomes great they will of necessity meet the demand. As soon as it becomes the universal practice to accept no seed that has been shelled a great step will have been taken toward the raising of the average production per acre, for it will take from unscrupulous men one means of imposing upon the growers by the sale of poor seed.

Properly grown and selected seed will often produce 15 bushels more corn per acre than unselected seed of the same variety. A bushel of seed will plant 6 or more acres, so that, estimating corn at 30 cents per bushel, such seed corn bears a money value of $27 per bushel.